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ABSTRACT

The keyword method of vocabulary acquisition is a two-step mnemonic technique for learning vocabulary terms. The first step, the accustic link, generates a keyword based on the sound of the foreign word. The second step, the imagery link, ties the keyword to the meaning of the item to be learned, via an interactive visual image or other association. An experiment assessed the effectiveness of this technique. Participants were 60 Army enlisted personnel, 20 from each of three ranges of general technical aptitude. The subjects learned the English translations of 15 Korean vocabulary terms at a self-paced rate. Half the subjects in each group were instructed in the keyword technique and were supplied keywords for each vocabulary item, while the remaining subjects served as a control group. According to the most representative criterion, the keyword group performed 79% better than the control group. (Author/JB)

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Technical Report 439

THE KEYWORD METHOD OF VOCABULARY ACQUISITION: AN EXPERIMENTAL EVALUATION

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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Technical Report 439

THE KEYWORD METHOD OF VOCABULARY ACQUISITION: AN EXPERIMENTAL EVALUATION

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FOREWORD

This report is concerned with the evaluation of a mnemotechnic (memory technique) for enhancing the rate of vocabulary acquisition. A review of the literature on this mnemotechnic, the keyword method, is provided as well as an experiment evaluating the effectiveness of the keyword method for military personnel. Research for this report was done as In-house Laboratory Independent Research under Army Project 2T161101A91B. Although this report should be of most direct interest to the Defense Language Institute, the principles and data included in the report should be valuable to any agency interested in increasing the rate of information acquisition for military personnel.

JOSEPH ZEIDNER
Technical Director

THE KEYWORD METHOD OF VOCABULARY ACQUISITION: AN EXPERIMENTAL EVALUATION

BRIEF

Requirement:

The keyword method of vocabulary acquisition is a two-step mnemotechnic for learning vocabulary terms. The first step, the acoustic link, generates a keyword based on the sound of the foreign word. The second step, the imagery link, ties the keyword to the meaning of the item to be learned, via an interactive visual image or other association. Say, for example, that the keyword method is used to learn the Korean term, p'o su, meaning gunner. The first step is to generate a keyword, for example "poor Sue." The second step is to link this keyword to the memory by an image, say a mental picture of poor Sue, the gunner. Although this technique may seem involved, other research has indicated it is effective.

The first objective of this experiment was to assess the utility of this technique with military personnel, using a language that has not been previously investigated regarding the keyword technique. The second objective was to assess the general utility of mnemotechnics (memory techniques) for military personnel. Previous research has indicated that mnemotechnics might only be effective when used by personnel with General Technical (GT) scores 110 or over.

Procedure:

A factorial experimental design was employed which crossed two levels of instructional set (a keyword group vs. a control group), three levels of General Technical Aptitude (90 and below, 91 through 109, and 110 and above), and two different 15-word Korean lists.

Sixty enlisted personnel participated, with five in each of the 12 groups. Participants paced themselves during both study and test phases. Participants, run individually, continued until either they successfully gave the 15 correct English translations of the Korean terms or until the 40-minute session ended. At the end of the session participants evaluated the technique.

Findings:

In addition to the subjective evaluation, four objective criteria were used: the number correct on the final trial, the total study time, the Study Efficiency Ratio (SER = number correct on final trial divided by total study time), and the total test time. In terms of the number correct, the total study time, and the SER, one list version was more difficult than the other, performance was a positive function of GT aptitude, and participants using the keyword technique performed better than control subjects. With respect to the most representative criteria, the SER, participants using the keyword method performed 79% better than the control participants. The subjective evaluation mainly corroborated the objective findings. Analysis of the total test time indicated that the high GT group required less testing time.

These findings argue specifically for the utility of the keyword method, and, more generally, for the utility of mnemotechnics for military personnel regardless of mental aptitude.

Utilization of Findings:

These findings should be of direct interest to the Defense Language Institute. As a training method, the keyword technique has potential application to the four following groups: (1) linguists; (2) personnel who are already in or are about to be transferred to non-English speaking host countries; (3) personnel learning English as a second language; and (4) personnel in the Basic Skills Education Program (BSEP). More generally, these findings point to the potential of incorporating mnemonics and mnemotechnics into military training.

THE KEYWORD METHOD OF VOCABULARY ACQUISITION: AN EXPERIMENTAL EVALUATION

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THE KEYWORD METHOD OF VOCABULARY ACQUISITION: AN EXPERIMENTAL EVALUATION

INTRODUCTION

The keyword method of vocabulary acquisition is a mnemotechnic (memory technique) designed to increase the speed of acquisition of new vocabulary terms. The keyword technique consists of two steps. The first step involves the creation of keyword based on the sound of the to-be-acquired item to serve as an acoustic link. Take, for example, the Korean term for airplane hangar, Kyok nap ko. Here the keyword could be "nap." The second step involves associating the keyword, "nap" to the meaning of Kyok nap ko, "airplane hangar," by means of mediating visual image, the imagery link. For instance, the keyword "nap" might be linked to the meaning, airplane hangar, by, forming a visual image mentally of someone taking a nap in an airplane hangar. Later, when the term Kyok nap ko is encountered, the sound "nap" will likely trigger the mental image of someone taking a nap in an airplane hangar, which will allow the retrieval of the appropriate meaning.

That the above mental gymnastics could enhance vocabulary acquisition might seem improbable until it is realized that there are several respectable studies in the experimental literature indicating that the technique works. Ott, Butler, Blake, and Ball (1973) assessed the utility of the keyword technique for the acquisition of the English interpretations of twenty-four one-syllable German nouns and adjectives. Ott et al. employed four experimental conditions. In one condition subjects were shown slides of pictures of the keywords along with the English translation as the German words were presented aurally. In a second condition subjects saw slides of the English translations of the aurally presented German words and were instructed to form their own keywords and to link the keyword to the English translation via an interactive image. The remaining two conditions were control conditions. One condition was a rote rehearsal control group which was instructed to learn the English translations by repeating the German and English pairs over and over. The other control group was simply instructed to learn the English translations of the German words. The list was presented once at a twelve seconds per item rate. Recall was assessed immediately after the entire list had been presented, then again eight minutes after completion of initial testing, then again two weeks later. The two control conditions were significantly inferior to the two experimental conditions on all three tests. Subjects who were required to generate their own keywords and mediating images did not do as well as subjects who were provided the mediating image based on the keyword. The two experimental groups scored about equally well on the delayed retention test, however. The experimental groups performed about twice as well as the control groups on all recall tests.

The Ott et al. (1973) study might be regarded as somewhat

limited since only one-syllable German words were employed. A series of experiments by Raugh and Atkinson (1974, 1975) employed Spanish words and included words of more than one syllable. In their first experiment all subjects were first taught keywords for a 60-word Spanish vocabulary. Then the subjects were divided into experimental and control groups. The experimental group was instructed to use mental imagery to associate each keyword to the appropriate English translation. The control group was instructed to learn the English translation by rote rehearsal. The first test scores were 88% correct for the experimental group versus 28% correct for the control group. Their second experiment was similar to their first except that the test vocabulary keywords were not prelearned. Here the results were 59% correct for the experimental group and 30% correct for the control group. The third experiment compared the keyword condition against a control condition that was allowed to use any learning strategy except the keyword strategy. A within-subjects design was employed here. Although many subjects reported using the keyword technique for some of the control items, the keyword group still outperformed the control group by 54% correct to 45% correct. A fourth experiment was similiar to the third experiment except that a free choice condition was added in which a subject could request a keyword if desired. Here the final test scores were 59%, 57% and 50% for the free-choice, keyword, and control condition, respectively. Although the free choice and keyword conditions did not differ significantly from each other, they were both significantly superior to the free choice control condition. Under the free choice condition, subjects were more likely to request a keyword for the more difficult items.

Atkinson and Raugh (1975) extended their research on the keyword method to a non-Romance language, Russian. They employed a between-subjects design and a 120-word Russian test vocabulary. Forty-word vocabularies were presented on each of three sessions. On the comprehensive test, the keyword group averaged 72% correct versus 46% correct for the control group that was instructed simply to learn the English translations however they wished.

The foregoing studies were formal experiments in which the subjects were not enrolled in a foreign language course for the particular foreign language under study. Raugh, Schupbach, and Atkinson (1977) did a study in which the subjects were second year students of Russian. Thirteen students studied a large basic vocabulary over an eight to ten week period. Vocabulary words were presented via a computer and subjects were given the option of being supplied a keyword for a vocabulary item if they so requested. Across the entire period of the study, the probablility of requesting a keyword the first time a particular vocabulary word was presented was greater than .70. Subsequently, keywords were more likely to be requested if the item had been missed on previous test trials. Most students reported that the keyword technique was

highly effective.

Not all studies on the keyword technique have revealed positive effects. Willerman (1977) examined the utility of the keyword technique for first year college French students. Moreover, she examined French vocabulary production in addition to English translation as dependent variables. Willerman found no facilitating effect for the keyword technique under any conditions. In fact, some students were quite negative to the keyword technique. A close examination of her instructions and procedures suggest that the instructions and procedures are likely reasons why she did not obtain significant effects. Her instructions were minimal and very little was provided in the way of training and feedback to assure that the students understood the technique.

Before proceeding further, two points should be realized about the keyword technique. First, most proponents of the keyword technique would probably agree that the technique should not be applied for every vocabulary word. The technique is probably best applied when more common techniques fail. Before employing the technique, the student would do well first to try to recognize any common roots or cognates the to-be-learned item might have with vocabulary that is already known. If no common roots or cognates are found, then a keyword can be used to learn the term. Indeed, this strategy was the model one for the subjects in the Raugh et al. (1977) study. Second, it should also be realized that the keyword technique is not applicable only for the acquisition of a recognition vocabulary for a foreign language. The technique is more generally applicable for the learning of new vocabulary, be that vocabulary foreign, native, or technical.

In the present study, four subpopulations within the Army were identified that might potentially benefit from the keyword method of vocabulary acquisition. The most obvious subpopulation, of course, consists of Army linguists. A second subpopulation consists of those soldiers about to be sent to a foreign, non-English-speaking country. A third subpopulation consists of soldiers for whom English is not their native language and whose English abilities are deficient. A fourth subpopulation consists of those individuals with vocabulary deficiencies stemming from a lack of basic educational skills. Such individuals could be placed in a Basic Skills Education Program (BSEP) that incorporates the keyword technique.

For a first experiment employing a military sample it was decided that a more general assessment of the utility of the keyword technique could be accomplished if a broad sampling of the enlisted population were done. A good basis for assuring a broad sampling is to employ general technical (GT) aptitude scores as sampling criteria. The GT aptitude test is a measure of general

academic aptitude and has an empirical mean of 100 and a standard deviation of 20. Individuals with GT scores below 90 are usually eligible for participation in the Basic Skills Education Program (BSEP). Such individuals can be regarded as low aptitude. Individuals with GT scores of 110 or higher have been regarded as eligible for further testing for officer candidate schools. Such individuals can be regarded as having high aptitude. Individuals with GT scores between these values can be regarded as having moderate aptitude. These three ranges of GT aptitude were employed in the current experiment.

This research on the keyword mnemotechnic is related to the more general issue regarding the feasibility of mnemotechnical training for military personnel. An experiment by Griffith and Actkinson (1978) indicated that whereas individuals in the GT 110 and above group were able to use a rhyme pegword mnemotechnic to advantage, the moderate and low GT groups demonstrated no significant facilitation. Griffith and Actkinson used a paced procedure during both the study and the test phases of the trials. They speculated that perhaps this paced procedure was responsible for the failure of the mnemotechnic to enhance the performance of the low and moderate GT groups.

The current study, then, employed an unpaced study test procedure and used personnel from the following three ranges of GT aptitude: 90 and below, 91 through 109, and 110 and above. Half the individuals in each of these groups were given instructions and practice in using the keyword technique and were given a keyword to each vocabulary item. The remaining subjects served as a control group and were allowed to learn the vocabulary items however they normally would. Korean was chosen as the target language as no previous studies on the keyword technique had employed Korean and as Korean is a language spoken in an area where U.S. Army troops are deployed.

OBJECTIVES

1. To assess the utility of the keyword method of vocabulary acquisition for military personnel.

2. To assess the potential of mnemotechnical training for personnel of high, moderate, and low General Technical aptitudes.

METHOD

Design and Subjects

A 2 (Instructional Set) by 3 (GT Level) by 2 (List Version) factorial design was employed. All factors were manipulated between subjects. The two levels of instructional set were the keyword group versus the control group. The three GT levels encompassed the following ranges: 90 and below, 91 through 109, and 110 and above. Two different lists of fifteen Korean military terms each were employed to enhance the generality of the findings. A total of 60 subjects, 20 from each of the GT levels, was employed in the data analysis. Subjects were randomly assigned to instructional sets and list versions with restriction that all the cells in the design be filled at the same rate.

Procedure

Subjects were run individually. At the outset of the session the subject was informed that the Army Research Institute was conducting a study to determine how rapidly soldiers can learn foreign vocabulary words, and that the current study involved Korean words. The instructions for the keyword and the control subjects are presented in Appendixes A and B, respectively. Both groups heard ten Korean words to familiarize them with the sound of the language. For the keyword subjects these same ten words were used to give instruction in the keyword technique. They were given examples of how a keyword could be employed to form an image by linking the keyword to its appropriate translation. For the remaining six words, keyword subjects were supplied a keyword and were asked to describe the image they formed linking the keyword to its appropriate translation. Feedback was provided on their efforts.

At the conclusion of this instructional phase the experiment proper was begun. During the study phase subjects were shown the English translations of Korean words on 3" x 5" cards as the Korean was repeated at approximate intervals of five seconds by the experimenter. The procedure was self-paced, subjects indicating when they were ready to go on to the next item. This procedure was identical for keyword and control subjects except that for the keyword subjects keywords were presented in parentheses alongside the English translation on the 3" x 5" card. After all fifteen items had been presented the test phase was begun. During the test phase a Korean word was pronounced at approximate intervals of five seconds. A given item was repeated until the subject either responded with the correct English translation or requested the next item. This procedure continued until all fifteen items had been tested. If all items were responded to correctly, then the session was over. If not, the procedure was repeated until either

all fifteen items were responded to correctly or until 40 minutes from the beginning of the first trial had elapsed. Subjects were not stopped if time elapsed during a trial. Rather, if it was estimated that there was insufficient time for another trial, the session was ended. The cards were reshuffled before each study trial. Three different test orders were used during the test phase. At the end of the session keyword subjects were asked to rate the keyword technique on a scale from zero (completely useless) to four (of maximum use). All subjects were debriefed.

Lists

Two different 15 item lists of Korean military terms were employed. These lists are presented in Appendix C.

RESULTS

The four following dependent variables were employed in the data analyses: the number correct on the final trial; total study time (i.e., the study time per trial summed across an individual's trials); a derived measure, the Study Efficiency Ratio (SER), which is the number correct on the final trial divided by the total study time; and the total test time (i.e., the recall test time per trial summed across an individual's trials). Separate univariate analyses were computed on each dependent variable.

Number Correct on Final Trial

A summary of the number correct collapsed over list version is presented in Table 1. A 2 (Instructional Set) by 3 (GT) by 2 (List Version) ANOVA yielded straightforward results. Whereas all three main effects are statistically significant, no interactions are (all interaction F's <1.17). The instructional set effect, F (1,48) = 14.82, $p<.01$, reflects the superior recall of the keyword group. An analysis of the GT effect, F (2,48) = 11.33, $p<.01$, reveals that recall is a positive function of GT aptitide. Newman-Keuls tests substantiate that all three means differ significantly ($p<.05$) from each other. Although the different list versions were not intended to represent different levels of difficulty, the significant effect of list, F (1,48) = 5.77, $p<.05$, indicates that list A ($\bar{x}$ = 10.63) is easier than List B ($\bar{x}$ = 8.2). The MS error for all the above tests is 15.392.

TABLE 1

Mean Number Correct on the Final Trial as a Function of Instructional Set and General-Technical (GT) Aptitude

	Instructional Set		
GT Range	Keyword	Control	$\bar{x}$
$\geq$ 110	13.5	11.4	12.4
91-109	12.1	6.4	9.2
$\leq$ 90	8.5	4.6	6.6
$\bar{x}$	11.4	7.5	

Total Study Time

The results for total study time, collapsed across list version, are presented in Table 2. The same 2 (Instructional Set) by 3 (GT) by 2 (list Version) ANOVA as was run on the number correct was run on the total study time, and this ANOVA reveals a similar pattern of results. The effect of instructional set, F (1,48) = 8.26, $p<.01$, is attributable to the keyword group requiring less total study time than the control group. The GT effect, F (2,48) = 4.79, $p<.05$, indicates that the low and moderate GT groups require less total study time than does the low GT group. The effect of list version, F (1,48) = 17.94, $p<.01$, again reflects that List B ($\bar{x}$ = 968 secs.) is more difficult than List A ($\bar{x}$ = 752 secs.) All interaction F's are less than 1.00. The MS error for all the above tests is 38,861.

TABLE 2

Mean Total Study Time (in seconds) as a Function of Instructional Set and General-Technical (GT) Aptitude

	Instructional Set		
GT Range	Keyword	Control	$\bar{x}$
$\geq$ 110	738	868	803
91-109	730	881	805
$\leq$ 90	893	1050	971
$\bar{x}$	787	933	

Study Efficiency Ratio (SER)

The SER is employed to combine in one measure the dependent variables number correct on the final trial and the total study time required to achieve that number correct. The SER is defined as the number correct on the final trial divided by the total study time. These values have been multiplied by 1,000 for ease of presentation. Accordingly, the larger the ratio, the more efficient the study indicated. Given that the analyses of the number correct and the total study time reveal a similar pattern of

results, the analysis of the SER should reveal nothing new. Of all the dependent measures, however, the SER is viewed as the single best criterion for this study.

A summary of the SER's, collapsed over list version, is presented in Table 3. A 2 (Instructional Set) by 3 (GT) by 2 (List Version) ANOVA reveals a pattern of results similar to that obtained with the other dependent variables. The instructional set effect, F (1,48) = 16.49, $p<.01$, again indicates the vastly superior performance of the keyword group. The GT effect, F (2,48) = 10.94, $p<.01$, reflects that study efficiency is a positive function of GT aptitude. Newman-Keuls tests indicate that all three means differ significantly ($p = .05$) from each other. The list effect F (1,48) = 11.67, $p<.01$, again is attributable to List B ($\bar{x}$ = 9.5) being more difficult than List A ($\bar{x}$ = 15.5). All interaction F's are less than 1.00. The MS error for all tests is 46.283.

TABLE 3

Mean Study Efficiency Ratios (SER = # correct final trial ÷ total study time) as a Function of Instructional Set and General-Technical (GT) Aptitude

	Instructional Set		
GT Range	Keyword	Control	$\bar{x}$
≥ 110	20.8	14.6	17.7
91-109	17.1	7.4	12.2
≤ 90	10.3	4.9	7.6
$\bar{x}$	16.1	9.0	

Note: The above values have been multiplied by one thousand for ease of presentation.

Total Test Time

A summary of the total recall test time, collapsed over list version, is presented in Table 4. A 2 (Instructional Set) by 3 (GT) by 2 (List Version) ANOVA indicates statistical significance for only GT, F (2,48) = 8.34, $p<.01$. This effect is apparently attributable to the high GT group requiring less test time than the moderate or low GT groups. The F ratios for the instructional set and list effects are less than 1.00. Of the interactions, only the instructional set by GT interaction F is greater than 2.00, F (2,48) = 2.36, $p>.05$, and the three way interaction is greater than 1.00, F (2,48) = 1.21, $p>.05$. The F's for the other two interactions are less than 1.00. The MS error for all tests is 40,024.

TABLE 4

Mean Total Test time as a Function of Instructional Set and General-Technical(GT) Aptitude

	Instructional Set		
GT Range	Keyword	Control	$\bar{x}$
$\geq$ 110	681	854	767
91-109	1027	960	994
$\leq$ 90	909	958	989
$\bar{x}$	909	924	

DISCUSSION

The results of this experiment are remarkably straightforward. The keyword technique is highly effective. Regardless of the intellectual aptitude of the subjects or the difficulty of the material, the keyword technique works. In fact, when the measure most indicative of performance, the SER, is employed, the keyword group's performance is 79% better than that of the control group.

The potential, then, of the keyword method of vocabulary acquisition is quite high. The current experiment on the keyword method was the first done involving military personnel. Moreover, this study on the keyword method is the first involving the Korean language. There is little correspondence between the Korean and English language even regarding their phonetic systems. A priori such lack of phonetic correspondence might lead to the conclusion that keyword development and keyword recognition would be problematic. Any such difficulties certainly did not obscure the overwhelming effectiveness of the keyword technique. Moreover, the vocabulary terms were restricted to words used in a military context. Thus, it might be expected that item similarity would result in semantic confusions among mediators. Again, any such difficulties did not obscure the overwhelming effectiveness of the keyword technique.

At the beginning of this paper, four subpopulations of military personnel were identified that might benefit from the keyword technique. They were (1) Army linguists; (2) soldiers deployed or about to be deployed to a non-English speaking host country; (3) U. S. soldiers having trouble learning English as a second language; and (4) soldiers enrolled in the Basic Skills Education Program (BSEP). Although further research needs to be done with each of these subpopulations, the indications from the current study are all positive. In fact, it might be concluded that the keyword technique would be of least use to Army linguists as a result of their extensive linguistic training. Interviews (see Appendix E) of linguists, however, indicated that they are favorably disposed towards the technique.

With respect to vocabulary acquisition, additional questions also need to be addressed. So far the technique has demonstrated success only with passive (recognition) vocabulary. Although Willerman's (1977) study failed to show positive effects for active vocabulary, she also failed to show positive effects for passive vocabulary. This question needs to be addressed further. Another issue regards the effectiveness of the technique in a classroom situation. One study (Fuentes, 1976) found that the technique's effectiveness was lost in a classroom setting. Although a recent series of experiments (Levin, Pressley, McCormick, Miller, and Shriberg, 1979) have identified possible reasons for this loss of

effectiveness in a classroom setting, this issue also needs to be addressed further. Finally, the question of whether it is more cost effective to supply keywords to students or to train them to derive their own keyword needs to be addressed.

The second objective of this report was broader than the first, and that was to assess the general utility of mnemotechnical training. It will be remembered that Griffith and Actkinson (1978) found that mnemonic instructions facilitated performance only for those individuals comparable in academic aptitude to the college population, those with GT scores of 110 or higher. Griffith and Actkinson employed a paced procedure, however. They argued that perhaps moderate and low GT aptitude individuals could effectively use a mnemotechnic, but the time constraints in the Griffith and Actkinson study precluded them from doing so. The current experiment supports this argument. Given sufficient time, moderate and low aptitude individuals are able to use a mnemotechnic to advantage. Appendix D presents summaries of study and test times, and provides recommendations for classroom use. Another argument that has been advanced regarding the use of the keyword technique and a paced procedure with high aptitude individuals is that the paced procedure differentially inhibits control performance as contrasted with keyword performance (J.W. Hall, Note 1). According to this argument both the keyword and the control groups engage in mnemonic elaboration. Control subjects, however, have to decide which strategy to use and how to develop mediators, etc., whereas keyword subjects have their strategy clearly delineated for them. Consequently, under a paced procedure control subjects are inhibited rather than keyword subjects facilitated. The current experiment contraindicates this argument. Even under the unpaced condition, the high GT keyword group still outperformed the high GT control group. This finding applies even though some control subjects reported using some rather sophisticated strategies during their experimental debriefings.

Clearly then, the appropriate use of mnemotechnics promises an enhancement of training regardless of the aptitude level of personnel. The acquisition of Korean vocabulary is a difficult task, yet the current experiment indicates an enhancement of memory performance across all levels of mental aptitude. Still, much research must be done and mnemonics and mnemotechnics must be incorporated into training carefully. A technical report by Griffith (1979) provides a review of the training potential of mnemonics and mnemotechnics as well as a suggested program of research and implementation.

CONCLUSIONS

The following conclusions are offered:

(1) The keyword method is an effective technique for teaching military personnel foreign vocabulary.

(2) Mnemonics and mnemotechnics, when appropriately applied, promise significant training enhancement regardless of the mental aptitude of the personnel being trained.

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Appendix A

KEYWORD INSTRUCTIONS

Hello, my name is _____ and I am from the Army Research Institute. According to my information, you are _____. We're doing a study to determine how rapidly soldiers can learn foreign vocabulary words. This study concerns Korean. Do you know any Korean? We're going to learn a list of twenty vocabulary words. As soon as you've learned these words you can go.

Before we go on with the list, I want to teach you a technique that has been used to facilitate the learning of the English translations of foreign words. This technique is called the Keyword technique, and here's how it works. The first step of this technique is to invent a Keyword based on the sound of the foreign word. For example, the Korean term for gunner is p'o-su. A good Keyword for p'o-su is "poor Sue." The second step involves forming a link between the Keyword and the English translation by forming an image, that is, a mental picture, relating the Keyword to its English translation. For example, you could form a mental picture of a female soldier by the name of Sue manning a gun. You might even elaborate this picture by imagining rain and seeing poor Sue the gunner in the rain. The next time you hear the Korean word p'o-su, the sound should remind you of "poor Sue," which in turn should remind you of the mental picture of poor Sue the gunner in the rain. This mental picture, then, reminds you of the meaning, "gunner." Do you have any questions? Do you see how the technique is supposed to work?

Sometimes the Keyword will be based on only part of the sound of the foreign word. For example, the Keyword for Kyok nap ko, meaning airplane hangar, might be "nap." You might then form a mental picture of yourself taking a nap in a hangar. Again, the idea is that the sound nap will trigger the mental picture of you taking a nap in a hangar. You should then remember the meaning, "hangar."

Sometimes, the translation will be abstract, that is, not easy to picture. You will see, however, that with a little imagination you can make an abstract idea into a picture. Take the Korean word chon-buk, meaning subsersion. Say the Keyword for chon-buk is "book." You could imagine a picture of a book on subversion.

The images you form don't have to make sense. NO MATTER HOW ILLOGICAL OR NONSENSICAL A MENTAL PICTURE MIGHT BE, MENTAL PICTURES ARE POWERFUL MEMORY AIDS. For example, say that the Keyword for the Korean word chi rae, meaning a land mine, was "gee ray." You could form a mental picture of a land mine giving off "G-rays." If you formed this mental picture vividly, it is very likely that the next time you heard chi rae, you would think of this mine giving off G-rays. In turn, this image would remind you of the Korean word's meaning.

Do you have any questions? In this study the Keywords will be supplied to you. You, however, are responsible for forming your own images linking the Keywords to the translations. I am now going to pronounce some Korean words and to show you their Keyword and translations on 3x5

cards. I am going to ask you to describe for me the images you form linking the Keywords to the translations.

Korean	Keyword	Translation
dae po	(diaper)	cannon
t'an yak	(tan yak)	ammunition
hon-byong	(hen)	military policy
kong-byong	(Kong)	engineer
tul kyok	(tall cook)	charge
pun kyon dae	(bun candy)	detachment

Any questions? We want you to use this technique in the vocabulary words to come.

Here's how we're going to proceed. I'm going to show you the Keyword in parentheses along with the English translation of a Korean word. As I am showing you the translation, I will repeat the Korean word three times. During this time you should listen carefully to my pronunciation and try to form an image linking the Keyword to its English translation. Later I am going to pronounce the Korean word and ask you to remember its English translation. If you have formed a good image linking the Keyword to the translation, the Korean word should remind you of the Keyword which, in turn, should remind you of the correct translation. Take as much time as you want. I'll repeat the Korean pronunciation over and over. When you are ready, say "next," and we'll go on to the next card. We'll repeat this procedure until we've gone through the

entire list of fifteen cards. Then you'll be tested. I will prounounce the Korean words over and over and ask you to give me the English translations. During testing you will not see the Keywords; the Korean words should remind you of the respective Keywords.

We'll repeat this procedure until you get all fifteen correct. Are there any questions?

Appendix B

CONTROL INSTRUCTIONS

Hello, my name is _____ and I am from the Army Research Institute. According to my information, you are _____. We're doing a study to determine how rapidly soldiers can learn foreign vocabulary words. This study concerns Korean. Do you know any Korean? We're going to learn a list of fifteen vocabulary words. As soon as you've learned these words you can go.

Here are some Korean words similar to the ones we'll be learning:

p'o-su - gunner	t'an yak - ammunition
kyok-nap-ko - airplane hangar	hon-byong - military police
chon-buk - subversion	kong-byong - engineer
chi rae - land mine	tul kyok - charge
dae p'o - cannon	pun kyon dae - detachment

Here's how we're going to proceed. I'm going to show you the English translation of a Korean word on a 3x5 card. As I am showing you the translation I will repeat the Korean word three times. During this time you should listen carefully to my pronunciation and study its English translation. Later I am going to pronounce the Korean and ask you to remember its English translation. Study the word as long as you like. I'll repeat the Korean pronunciation over and over. When you are ready, say "next," and we'll go on the next word. We'll repeat this procedure until we've gone through the entire list of fifteen cards.

Then you'll be tested. I will pronounce the Korean word over and over and ask you to give me the English translations.

We'll repeat this procedure until you get all fifteen words correct. Are there any questions?

Appendix C
Experimental Lists
Version A

Korean	Transliteration	Keyword	English Translation
중 대	chung dae	(June Day)	Company
전 차	chun cha	(cha cha)	tank
보 병	bo - byong	(bow)	infantry
기 병	ki - byong	(key)	cavalry
저 격 병	cho - kyok - byong	(jaw cook)	sniper
포 병	po - byong	(pour)	artillery
어 디	o di	(udder)	where
사 단	sa - dan	(sedan)	division
폭 탄	p'ok t'an	(buck ten)	bomb
분 대	bun dae	(bun day)	squad
박 격 포	buk kyok p'o	(pack yak)	mortar
소 총	so ch'ong	(sew)	rifle
공 격	kong kyok	(kong cook)	attack
통 역 관	tong - yok quan	(tongue)	interpreter
대 대	dae dae	(tea day)	battalion

Version B

Korean	Transliteration	Keyword	English Translation
반 격	pan kyok	(pan)	counter attack
군 단	kun dan	(gun den)	Army corps
연 대	yon dae	(young day)	regiment
작 전	chock chon	(jock)	operation
출 격	chull kyok	(chew cook)	pursuit
군 인	kunin	(gun)	soldier
무 장	mu chang	(change)	armament
시 가 전	si ga chan	(cigar)	street fighting
수 세	su se	(Sue see)	defensive
경 계 경 보	kyong gay kyong bow	(gay bow)	alert
보 초	bo - ch'o	(Poor Joe)	general
전 파 탐 지 기	chun p'a tam ji ki	(chin Pa)	radar
전 투 기	chant'u ki	(chant a key)	fighter plane
후 퇴	hu tea	(tea)	withdrawal
공 군 기 지	kong gun ki ji	(kong gun)	air base

Appendix D

A Summary of Study and Test Times and Recommendations for Group Presentations

Presented below is a summary of the study times and the test times by trial and by keyword and control groups. In the absence of anything better, this summary can be used to estimate suitable study and testing times for group presentations. Before using this summary in such a manner, however, a few points should be realized. First of all, the times presented below are not necessarily the optimal presentation times for this task. Rather, they represent how the participants chose to pace themselves in this study. Secondly, these times are very likely specific to the materials used (i.e., Korean terms). Moreover, the task material is exceptionally difficult. It is likely that with an easier subject matter these times would have been lower. Still, in the absence of better data, the current data can serve as a worst case estimate. The first step is to estimate the average GT aptitide of the group (in the absence of this knowledge, the low GT group can be used as a worst case estimate). For a given trial, the standard deviation can be added to the mean time for a given trial. By then dividing this time by fifteen, one obtains a presentation time per item.

Keyword-Mean Test Times (n's and s.d.'s presented in parentheses)

GT Group	Trial # 1	2	3
≥ 110	(10) 190 (58)	(10) 141 (40)	(9) 120 (37)
91-109	(10) 286 (108)	(10) 227 (95)	(10) 169 (50)
≤ 90	(10) 250 (94)	(10) 230 (94)	(10) 195 (71)

GT Group	4	5	6
≥ 110	(8) 122 (30)	(7) 99 (35)	(3) 99 (43)
91-109	(9) 142 (42)	(8) 145 (82)	(7) 119 (40)
≤ 90	(9) 175 (62)	(8) 137 (32)	(5) 89 (21)

GT Group	7	8	9
≥ 110	(2) 77 (6)	(2) 80 (1)	(2) 74 (6)
91-109	(2) 88 (29)	-	-
≤ 90	(3) 87 (19)	(1) 74	-

Control-Mean Study Times (n's and s.d.'s presented in parentheses)

GT Group	Trial # 1	2	3
≥ 110	(10) 141 (45)	(10) 146 (60)	(10) 142 (51)
91-109	(10) 202 (85)	(10) 188 (65)	(10) 166 (47)
≤ 90	(10) 214 (99)	(10) 227 (120)	(9) 166 (55)

GT Group	4	5	6
≥ 110	(10) 136 (78)	(9) 117 (34)	(8) 105 (43)
91-109	(8) 148 (35)	(8) 141 (37)	(6) 123 (26)
<90	(8) 147 (62)	(7) 154 (32)	(6) 139 (42)

GT Group	7	8	9
≥ 110	(7) 95 (35)	(4) 66 (8)	(1) 73
91-109	(5) 114 (43)	(3) 82 (21)	(2) 92 (7)
≤ 90	(3) 128 (51)	(1) 101	(1) 101

Keyword-Mean Test Times (n's and s.d.'s presented in parentheses

GT Group	Trial # 1	2	3
≥ 110	(10) 207 (94)	(10) 164 (58)	(9) 139 (41)
91-109	(10) 219 (89)	(10) 167 (76)	(10) 124 (49)
≤ 90	(10) 245 (154)	(10) 192 (79)	(10) 166 (63)

GT Group	4	5	6
≥ 110	(8) 130 (48)	(7) 102 (29)	(3) 94 (31)
91-109	(9) 87 (26)	(8) 82 (48)	(7) 88 (14)
≤ 90	(9) 144 (51)	(8) 102 (45)	(5) 93 (34)

GT Group	7	8	9
≥ 110	(2) 66 (5)	(2) 63 (2)	(2) 64 (8)
91-109	(2) 70 (13)	-	-
≤ 90	(3) 87 (29)	(1) 57	-

Control - Mean Test Times (n's and s.d.'s presented in parentheses)

GT Group	Trial # 1	2	3
≥ 110	(10) 191 (48)	(10) 154 (72)	(10) 143 (61)
91-109	(10) 197 (94)	(10) 189 (116)	(10) 162 (75)
≤ 90	(10) 312 (222)	(10) 284 (240)	(9) 197 (162)

GT Group	4	5	6
≥ 110	(10) 120 (43)	(9) 112 (50)	(8) 94 (38)
91-109	(8) 123 (24)	(8) 109 (27)	(6) 99 (35)
≤ 90	(8) 125 (31)	(7) 106 (30)	(6) 101 (23)

GT Group	7	8	9
≥ 110	(7) 75 (17)	(4) 61 (16)	(1) 73
91-109	(5) 92 (32)	(3) 86 (25)	(2) 86 (25)
≤ 90	(3) 101 (32)	(1) 64	(1) 59

Appendix E

A Summary of Interviews and Subjective Ratings on the Keyword Method of Vocabulary Acquisition

Preliminary to the development of the experimental materials, nine Army linguists (eight German, one Korean) were individually interviewed, given a brief description of the keyword technique, and asked for their opinions. Their responses were overwhelmingly favorable. With the exception of one German linguist, all were favorably disposed towards the technique and expressed a willingness to use the technique as instructors. The only concern regarding the technique involved the time and effort required to develop the keywords.

Later, incidental to the experiment proper, an Army linguist was run through the experiment under the keyword condition. This individual is a Russian linguist who also has studied Sanskritic languages and lived in Pakistan. Although he initially had reservations about the keyword technique, after using it he rated the technique on a scale of zero to four. He believed that, appropriately used, the technique was quite useful.

All subjects who were run under the keyword condition were similarly asked to rate the keyword technique on a scale from zero (completely useless) to four (at maximum use). The mean effectiveness ratings are 3.4, 3.3, and 2.6, for the high, medium, and low GT groups respectively. A Pearson r of .43 between the number correct on the final trial and the effectiveness rating suggests that an individual's recall performance might affect the effectiveness rating.

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